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ABSTRACT

This paper presents a viewpoint on educator responsibilities toward helping youth develop the skills necessary to cope with life as well as consideration on how to present science in a safe environment. Discussions include safety in the learning environment, litigation, effective teaching, effective schools, the goals of science, and the mandate for school safety. A set of challenges to science educators is presented as a summary to this paper. (CW)

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SAFETY IN THE ELEMENTARY SCIENCE PROGRAM

A COMPENDIUM OF SAFETY CONSIDERATIONS FOR THE ELEMENTARY SCHOOL SCIENCE TEACHER

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If we are to equip young people today to have productive and meaningful lives in the twenty-first century, *for which we have no blueprint*, then appropriate attention must be given to thinking and problem solving skills. Quality of life is dependent upon successful application of these skills.

This pamphlet is designed to present a viewpoint on educator's responsibilities toward helping our youth develop the skills necessary to cope in life as well as considerations on *HOW TO PRESENT SCIENCE IN A SAFE ENVIRONMENT.*

WHAT IS SCIENCE?

In order to accomplish any task and do it well, a knowledge of the EXACT nature involved with the task is important. Understanding the nature of science is the KEY to successfully teaching it. The following description of science is offered for the reader's consideration.

> "Science (as a verb) is a process for resolving problems and verifying knowledge." (Gerlovich, 1986)

Another way of defining science is: the process of finding answers.

Carrying out the above processes, we can build a body of knowledge and a base of facts upon which the quest for further answers is enhanced.

Because science is a process, it cannot be taught (or learned) effectively through vicarious participation. It is ESSENTIAL that active involvement by learners (often referred to as "Hands-on") be a major component of learning science processes.

For teachers of science, the bottom line for a successful science learning environment is -- students must be involved directly with learning all of the processes (North Carolina Teachers Handbook, 1985).

Any active, student involved, program carries the risk of accident and injury. We would be hard pressed to find any activity in life where there are no risks involved. This pamphlet provides a few thoughts that put the risks into perspective.

ACCIDENTS AND INJURY IN A SCHOOL PROGRAM

The state of Iowa conducted research of their school's safety records and derived the following statistics for the academic years 1977-1980, (Downs, 1983). The tables provide insights into the nature of accidents and injury as well as types of injury occurring and where they occurred:

TABLE 1.1. General Nature of Injury

Injury	Percentage
Bruises	41
Cuts	19
Sprains and strains	19
Fractures	11
Scratches	6
Concussions	2
Multiple injuries	2
Dislocations	1

Table 1.1 illustrates how often the injury types happened. It may be ascertained the most injuries are not life threatening. Table 1.2 shows that the upper body was most susceptible.

TABLE 1.2. Injuries to Various Parts of the Body

Injury	Percentage
Face	25
Head and neck	25
Hand and fingers	13
Leg	11
Arm	7
Ankle, foot, and toes	6
Eyes	5
Back	2
Shoulders	2
Multiple parts	2

Most injuries are minor and require little medical attention as noted in Table 1.3. Table 1.4 shows that the overwhelming majority of injuries occurring in school are not in the science classroom. In fact, during the Iowa study, it was found that less than 1% of all accidents occurred in science and most of those happened during field trips.

TABLE 1.3. Types of Accident Severity

Type	Percentage
First aid not required	8
First aid	57
Minor medical	26
Medical	8
Major medical	1
Fatality	1 case

It can be implied from the Iowa study that teachers of science are not a high risk group for accidents and injury. This study's findings may be assumed to be representative across the United States.

Proponents of, "science activity is a high risk venture", will find no support from the facts.

TABLE 1.4. Types of Activity

Type	Percentage
Recess	59
Gym/Physical exercise	14
Classroom activities	8
Hallway movement	5
Horseplay	4
Activities off school grounds	3
Fighting	2
Entering or exiting building	2
Athletics	1

SCIENCE TEACHING WITH SAFETY

A highly desirable goal of our schools is; the nurturing of thinking and problem solving skills. Methods for creating an environment where these skills can grow are probably as varied as there are teachers. Any single method, however, is likely to fall short of desired results -- if used in isolation. For example:

A school program where lecture is the sole method of instruction is likely to produce boredom, frustration, and little or no learning.

Other traditional methods of instruction that will probably produce undesirable results -- when used by themselves -- include:

Reading
Demonstration
Memorization
Copying "factual information"

A successful learning environment will likely combine the above mentioned methods with EXPERIENTIAL activities where the learners are involved in using the processes of discovery.

To experience both success and failure is to implant and practice mental processes where real learning takes place. Some of these processes include:

Observing, predicting, measuring, inferring, communicating and others. For a more complete listing of science processes, consult the North Carolina Teacher Handbook, Science.

SAFETY AND THE LEARNING ENVIRONMENT

Active participation in any facet of life carries the risk of accident and injury. Fortunately, few people go to the extreme of "locking" themselves out of life's mainstream in order to avoid risk. Teachers of science are ill advised to avoid student centered, active, hands-on learning because of potential dangers.

When planning for an optimum learning environment a teacher must, of course, seriously consider and anticipate risky activities. Effective teaching is at risk and in jeopardy . . .
. . . when paranoia about risk overcomes reason.

As one of the nation's leading proponents of teaching with safety states:

> "In promoting safety, to reduce the risk of accident and injury, a teacher need only cultivate the habit of carefully considering what could go wrong and prepare for such eventualities. This does not require clairvoyant powers, only the ability to reason."
>
> (Gerlovich, 1986)

Gerlovich further notes that educators need-not be superhuman in their ability to prevent troublesome situations when he says:

> "Teachers are not expected to have greater powers of reason than the public, only to have specific knowledge which they must take into account when they act reasonably."

Following are some specific points to consider when planning a science curriculum. It should be noted that these are prudent and reasonable precautions:

> The beginning of any new class should include specific instructions about acceptable and unacceptable behavior, especially in the laboratory. It would be wise to inform students, in writing, concerning enforcement of safety rules. It is also prudent to post the rules and provide written copies to any substitute teacher who will supervise the class.

With respect to instruction, be thoroughly prepared for what might go wrong. Anticipate the operation of Murphy's Law and take precautions.

Before undertaking an experiment or a class project, ascertain the risks and decide whether the students in that situation have sufficient maturity and ability to complete it safely and to learn from it. If the experiment, or project, is particularly dangerous, perhaps it should be presented as a demonstration in which the student merely observes rather than participates.

Knowingly allowing an unsafe condition to continue is worse than never discovering it in the first place.

Make certain that school authorities are informed concerning needed safety corrections which require their approval. Be certain that you make a written record of the transmission of such appraisals to administrators. The first responsibility rests with the teacher to exercise professional judgement concerning matters of safety. School officials should respect that judgement and not compromise on matters of safety in the face of budget restrictions.

(Gerlovich, 1986)

LITIGATION

Many cases in which educators have been brought to litigation reflect a lack of insight by the educator. This can be shown in the following selected cases involving science teaching:

A teacher and principal were held to have potential liability in Bush v. Oscoda Area School, even though the school district was protected by the doctrine of sovereign immunity. In this case, a student was burned when methanol caught fire during a science experiment which was being conducted in a mathematics classroom.

The room was not properly equipped with storage, ventilation, fire extinguisher, or fire blanket, and alcohol lamps were being used because gas burners were not available in the room. The methanol was stored in an allegedly damaged and leaking container. The classroom was being used due to a shortage of space in the science rooms. Negligence was cited for the failure to supervise, failure to instruct as to dangers, and failure to provide safe equipment and space.

Negligence was found against a school in Simmons v. Beauregard Parish School Board for lack of supervision when a thirteen year old student used a firecracker in a volcano project.

Finally, two elementary teachers were found liable in Guerrieri v. Tyson for injuries to a ten year old student whose finger they held in boiling water allegedly for the treatment of an infection. The teachers were found neither qualified nor authorized to employ such a radical emergency treatment.

It is inevitable that some educators will be called to court even when they were not at fault. Usually, these cases are found in favor of the educator. The following select cases demonstrate that justice does occur:

In Gaincott v. Davis, an elementary student fell off a chair while watering plants used in a school nature study. The child was using a glass bottle, which broke and cut her hand. Given that this case occurred in 1937, one might expect a different outcome today where the use of an unbreakable plastic would be deemed more reasonable and prudent.

A teacher was not held responsible for an eye injury in Madden v. Clouser, which had resulted when two students fought over a pencil, even though the teacher had left the room briefly. The court held that the teacher's absence was not a proximate cause of the injury.

EDUCATION'S MANDATE

There are many statements of exactly what schools are expected to accomplish. North Carolina very clearly states its mandate to provide educational opportunities for its citizens in grades kindergarten through twelfth grade as outlined in the Standard Course of Study, 1985.

Several key issues are extracted from the Standard Course of Study, herein, in order to highlight what is expected from North Carolina educators. Selected statements are presented herein for a succinct treatment of the main points relevant to our topic:

PURPOSE

> The Primary purposes of the North Carolina Standard Course of Study and the North Carolina Competency-Based Curriculum are (1) to help students become responsible, productive citizens and (2) to help students achieve a sense of personal fulfillment. It is clear that there are competencies which a student must develop in order to meet both of these purposes. ...Students must develop the skills and attitudes necessary to cope with contemporary society.

EFFECTIVE TEACHING

> ...It is the classroom teacher at each grade level or in each subject area who has the most direct influence on the implementation of the North Carolina Standard Course of Study and the North Carolina Competency-Based Curriculum.
>
> ...What the teacher presents and how the teacher presents it determines whether students feel the task is relevant to their lives.
>
> ...The teacher's efficient management of instructional time and student behavior are also important to the successful implementation of the curriculum in each classroom.

EFFECTIVE SCHOOLS

Several common characteristics will be present in the schools which most effectively implement the North Carolina Standard Course of Study and the North Carolina Competency-Based Curriculum. These characteristics include...

...Elements of a positive school climate are a safe and orderly environment,...

...Consideration must be given to the unique developmental needs--intellectual, physical, social, and emotional--of the served; for example, the need of young children for concrete, hands-on experiences...

SCIENCE

The primary goal of American education is to develop thinking and reasoning ability. The nature of science readily lends itself to this central purpose. Thus, the science curriculum, by emphasizing rational thought processes through active participation in scientific methods, will ensure that each child will become scientifically literate...

...It is most important that science instruction be available to each child at all grade levels.

NOTE: Underlined words have been added by this pamphlet's author.

SAFETY AND THE MANDATE

It should be readily evident that good safety considerations must be integrated into a program that espouses such active participation by all parties in the learning environment.

The mandate for educators, i.e., teachers, administrators and school board members (parents should be added to this list), appears quite clear:

It is incumbent on us to provide an environment for our young people in which thinking, reasoning and problem solving is required and enhanced. Within the same framework, that environment must be safe and comfortable. We must utilize all of our energy, training, experience and skill to ensure that this mandate is carried out.

SUMMARY

Challenges to the educator are formidable and real. For those of us who have selected a life of helping young people develop to their fullest potential, the following philosophies and practices are offered as standards in your daily classroom experience:

1. Require students to participate and think.

2. Maintain high expectations of student's involvement and behavior.

3. Intelligently blend all teaching strategies into an effective learning environment. Accentuate experience and involvement for all students.

4. Have the courage to plan and implement activities on a continuing basis, even in the face of potential hazards.

5. Utilize good sense, forethought, anticipation and consideration of a safe environment in your curriculum planning.

6. Accept the responsibility for the healthy, mental preparation of your students.

7. Practice and retain a sense vigor, creativity, purpose and dedication for the ultimate betterment of the children under your care and tutelage.

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